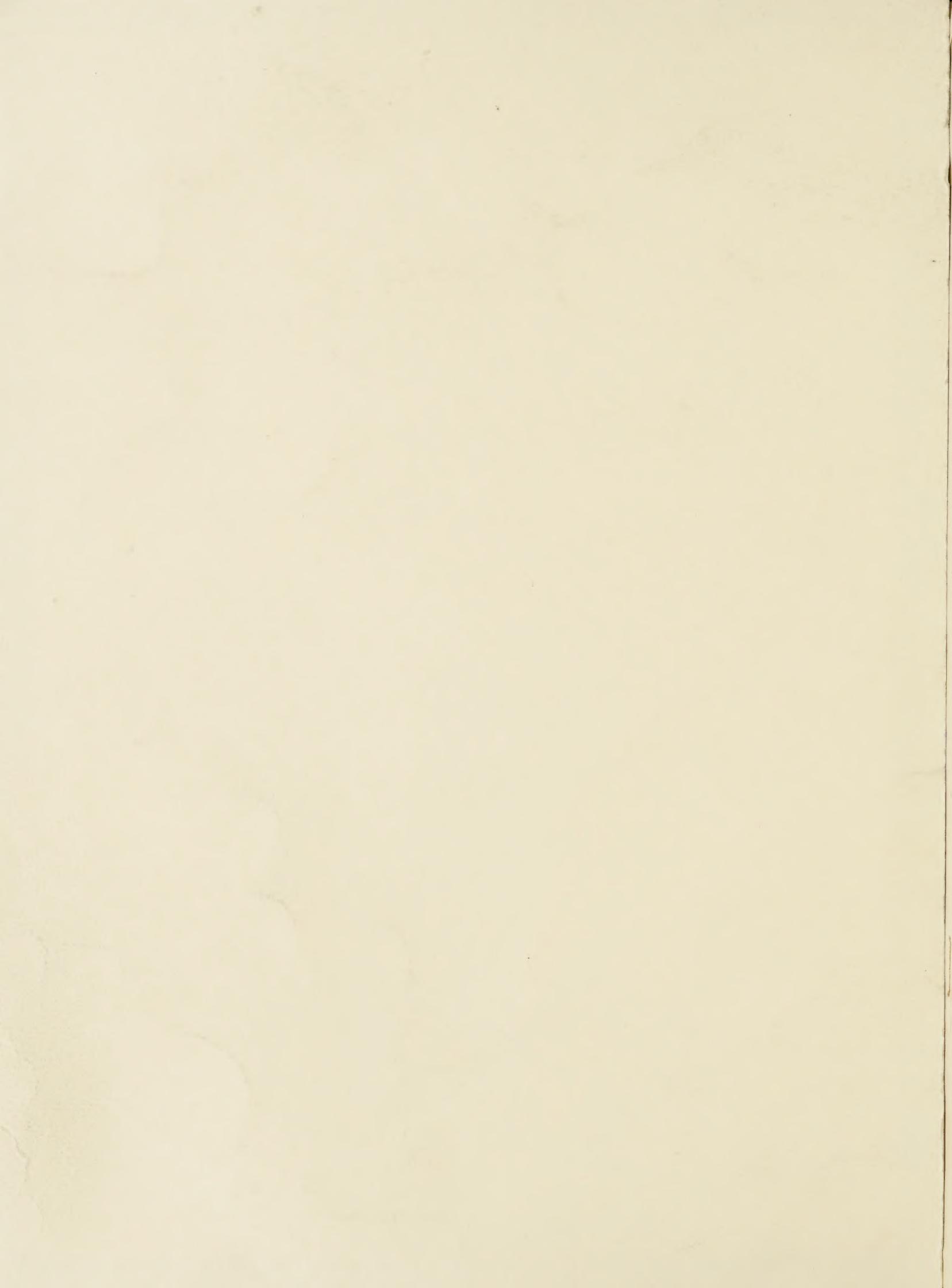
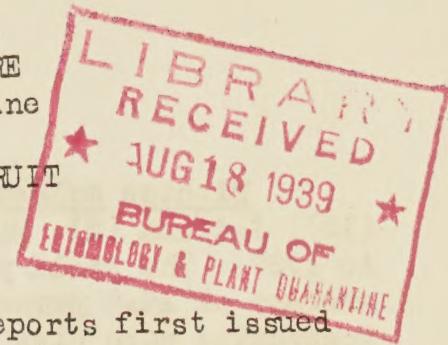


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1938UNITED STATES DEPARTMENT OF AGRICULTURE
Bureau of Entomology and Plant QuarantineREPORT ON COOPERATIVE WORK ON ORIENTAL FRUIT
MOTH PARASITES FOR 1938

This is a continuation of the series of annual reports first issued in 1934 upon the cooperative phases of the biological control work upon the oriental fruit moth in the eastern half of the United States.

Sixteen State organizations are now engaged in this work under formal memoranda of agreement. During the past year the agreement with one station was terminated and Rhode Island was added to the list. The Bureau phases of the work at Moorestown, N. J., have continued in charge of Dr. H. W. Allen, of the Division of Fruit Insect Investigations.

IMPORTATION AND COLONIZATION OF PARASITES

The importation program for 1938 was markedly reduced in comparison with preceding years. Large numbers of parasites have now been imported for a period of years and the present reduction permits of more attention being given to recovery studies by the Moorestown staff and of alternate host studies in the foreign field. Shipments received during 1938 comprised 6,051 adults of Phaeogenes haeussleri (Uch.) from Japan and 202 cocoons of Gambrus stokesii Cam. from Australia. The latter shipment was obtained through the courtesy of the Australian Council for Industrial and Scientific Research.

In table 1 is given a complete record, by States, of the colonies of the different parasites liberated during the year. These largely represent parasites reared at the Moorestown station, and many of the releases were made by cooperative agencies. Only three species, Macrocentrus ancylivorus Roh, Bassus diversus Mues. and Phaeogenes haeussleri were available for colonization, the total number being 36,288. In the 149 releases which were made the mortality prior to actual release in the field averaged only 2.7 percent.

Table 1.--Parasite releases against the oriental fruit moth in 1938.

States	<u>M. ancylivorus</u>		<u>Bassus diversus</u>		<u>P. haeussleri</u>	
	Number of releases	Number of parasites	Number of releases	Number of parasites	Number of releases	Number of parasites
Rhode Island	5	1,666			4	800
New York						
New Jersey			4	4,383		
West Virginia	5	983				
Virginia	2	389				
North Carolina	1	285				
South Carolina	23	5,289			4	800
Georgia	5	1,006			5	1,015
Kentucky					4	798
Ohio	8	1,641	67	13,876	4	800
Indiana					2	398
Michigan					2	394
Illinois					4	799
	49	11,259	71	18,259	29	5,804

RECOVERIES OF IMPORTED SPECIES

Dioctes molestae was recovered from 24 of the 60 properties in Ohio (15), Indiana (5), Michigan (1), and Illinois (3), where it was colonized in 1937. The field parasitization ranged from 1.4 to 79.2 percent, with an average of 14.9 percent of the total emergence from the sample material. Recoveries were also made from two localities in western New York where releases had been made prior to 1937, while none was secured from the localities in Connecticut, New Jersey, Pennsylvania, and Virginia where 1937 observations on colonies released in 1936 had indicated probable establishment. In those sections where the parasite persists it is, in general, somewhat less abundant the year following release than during the season of colonization.

Recoveries of single specimens of Bassus diversus were made in Massachusetts and Connecticut during 1938, both of these being at points not known to have been colonized. They may represent spread from colonies released at other points at which establishment has not as yet been recorded. The Connecticut recovery was in the same locality in which a single recovery was made in 1937.

RECOVERY COLLECTIONS

The recovery survey for 1938 covered approximately the same areas as in 1937, except that no collections were made in Delaware, while Rhode Island and West Virginia were added to the list. The total number of twigs collected for this purpose during the year was 59,232, in 555 lots, secured from 317 properties in 19 States. Of the above total 71.0 percent was collected and sent to the Moorestown station by cooperating State agencies, as compared with 73.2 percent of the total of 38,802 twigs collected in 1937.

The emergence secured from material submitted by State agencies was 54.7 percent as compared with 58.1 percent from that collected by the Bureau staff. The figures for collections from the different States are given in Table 2.

The complete recovery collections, by States and parasite species, are given in Table 3.

TABLE 2. - DATA ON RECOVERY COLLECTIONS - 1938

COLLECTIONS BY THE BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

State	Number of collections	Number twigs collected	Percent emergence
New Jersey	95	14,555	57.8
Pennsylvania	13	948	58.2
Maryland	7	490	62.0
Virginia	6	655	55.0
West Virginia	5	505	66.1

COLLECTIONS BY COOPERATING STATE AGENCIES

Massachusetts	18	939	45.0
Connecticut	25	2,237	66.2
Rhode Island	6	244	34.8
New York	70	6,220	49.9
Pennsylvania	5	325	33.8
Maryland	4	550	33.3
Virginia	31	3,346	60.7
North Carolina	6	849	59.2
South Carolina	29	3,676	55.4
Georgia	10	902	45.3
West Virginia	5	517	62.3
Kentucky	39	4,723	53.7
Ohio	92	9,829	54.3
Indiana	23	2,693	65.1
Michigan	8	790	38.1
Illinois	35	1,985	53.6
Missouri	15	1,629	61.0
Arkansas	8	625	55.8
Total	555	59,232	

TABLE 3. - RECOVERY REARINGS FOR THE COMBINED COLLECTIONS OF TWIGS BY
THE BUREAU AND STATE AGENCIES - 1938

As usual, the twig collections were made during the months of May to August, inclusive. The peak of parasitization was attained in July, as was the case in 1934 and 1936, as compared with August in other years. The average parasitization for June and July, as well as the average for the entire season, is the highest on record. The comparative figures for each year since 1931 are given in Table 4.

TABLE 4. - AVERAGE PARASITIZATION OF LARVAE IN TWIGS, BY MONTHS,
FOR 1931 - 1938, INCLUSIVE.

Year	May	June	July	August	Entire season
1931	16.0	13.8	37.7	45.5	28.2
1932	7.9	14.2	40.0	50.6	28.2
1933	17.9	12.6	35.5	58.6	31.2
1934	32.5	29.8	35.3	34.1	32.9
1935	11.7	22.3	39.8	61.9	33.9
1936	13.6	14.5	29.2	16.0	8.3
1937	8.6	20.0	42.4	54.1	31.3
1938	23.3	40.3	42.8	35.5	36.4

In table 5 is given a comparison of the percentages of parasitization, by counties, for the entire season of 1938, with those for the preceding seven years.

Table 5. -- Average parasitization for 1938 as compared with that of 1931-37, inclusive, based on counties in which values for those years are available.

	May	June	July	August	
1937	11	17.0	11.5	5.5	38 39.2 21.3 17.9 Average parasitization in 1938 Number of counties having values in both years compared.
1936	11	38.0	19.2	18.8	26 44.1 17.3 26.8 Average parasitization in 1938 Number of counties having values in both years compared.
1935	13	25.7	9.9	15.8	28 52.2 30.0 22.2 Average parasitization in 1938 Number of counties having values in both years compared.
1934	11	28.9	34.3	-5.4	35 47.3 25.0 22.3 Average parasitization in 1938 Number of counties having values in both years compared.
1933	10	33.4	28.5	4.9	25 46.2 14.4 31.8 Average parasitization in 1938 Number of counties having values in both years compared.
1932	12	36.1	14.1	22.0	32 49.5 14.0 35.5 Average parasitization in 1938 Number of counties having values in both years compared.
1931	7	42.6	28.4	14.2	24 47.4 14.0 33.4 Average parasitization in 1938 Number of counties having values in both years compared.
					20 51.0 38.5 12.5 Average parasitization in 1938 Number of counties having values in both years compared.
					17 48.9 29.9 19.0 Average parasitization in 1938 Number of counties having values in both years compared.
					18 48.1 43.5 4.6 Average parasitization in 1938 Number of counties having values in both years compared.
					24 46.7 38.2 8.5 Average parasitization in 1938 Number of counties having values in both years compared.
					22 54.5 45.5 9.0 Average parasitization in 1938 Number of counties having values in both years compared.
					17 55.3 50.3 5.0 Average parasitization in 1938 Number of counties having values in both years compared.
					14 53.3 38.7 14.6 Average parasitization in 1938 Number of counties having values in both years compared.
					6 31.5 39.1 -7.7 Average parasitization in 1938 Number of counties having values in both years compared.
					0 --- --- --- Average parasitization in 1938 Number of counties having values in both years compared.
					1 78.6 40.5 38.1 Average parasitization in 1938 Number of counties having values in both years compared.
					2 29.1 29.4 -3 Average parasitization in 1938 Number of counties having values in both years compared.
					0 --- --- --- Average parasitization in 1938 Number of counties having values in both years compared.
					2 64.8 25.7 38.8 Average parasitization in 1938 Number of counties having values in both years compared.
					5 46.8 80.5 -33.8 Average parasitization in 1938 Number of counties having values in both years compared.

Field parasitization of larvae in twigs in excess of 70 percent was recorded from one or more properties in the following 30 counties in 1938:

Connecticut	Ohio	Indiana
New Haven	Cuyahoga	Knox
Maryland	Erie	Sullivan
Washington	Fairfield	
New Jersey	Lorain	Michigan
Burlington	Lucas	Berrien
Mercer	Summit	
Virginia	Wayne	Pennsylvania
Albemarle	Illinois	Adams
Botetourt	Franklin	Bucks
Nelson	Jefferson	Franklin
South Carolina	Marion	York
Greenville	Pulaski	West Virginia
	Union	Berkeley
	Washington	Jefferson

A total of 36 species of parasites was reared from recovery collections made in 1938. As usual, Macrocentrus ancyllivorus was the dominant species, being taken in 67.2 percent of all properties from which collections were made, followed by Glypta rufiscutellaris, Cremastus minor and Macrocentrus delicatus in the order given. The decline of Dioctes molestae from third place in 1937 to eighth in 1938 is due to the fact that no releases were made in the latter year and consequently the buildup during the season of release was lacking.

In Table 6 is given a condensed tabulation of the relative values of the 10 most important parasite species for each year since adequate recovery collections have been made. It is seen that the distribution of Macrocentrus ancyllivorus has increased very markedly, whereas the remaining native species have not shown any consistent tendency in this direction.

Table 6. - Percentage of all properties surveyed in which the parasites listed were recovered each year from 1931 to 1938.

Species	1931	1932	1933	1934	1935	1936	1937	1938
<u>Macrocentrus aencylivorus</u>	32.0	30.1	38.6	48.3	51.3	44.4	54.2	67.2
<u>Glypta rufiscutellaris</u>	34.9	40.2	35.5	37.5	40.2	26.2	27.8	39.7
<u>Cremastus minor</u>	12.5	19.7	5.0	10.8	15.2	16.4	7.2	28.7
<u>Macrocentrus delicatus</u>	22.1	22.7	27.3	29.3	27.7	23.8	19.1	26.5
<u>Macrocentrus instabilis</u>	7.1	6.1	11.4	12.7	11.6	12.1	16.2	17.7
<u>Eubadizon pleurale</u>	3.2	4.4	4.1	11.6	12.9	10.3	5.1	17.7
<u>Diocetes obliteratus</u>	5.7	4.8	7.7	2.3	3.6	3.3	1.4	14.2
<u>Pristomerus ocellatus</u>	18.0	26.2	10.0	12.4	16.1	10.3	10.5	12.9
<u>Diocetes molestae</u>	0.0	0.9	1.4	0.8	6.3	5.1	20.2	8.2
<u>Bassus diversus</u>	0.0	0.0	0.0	0.0	0.0	1.9	2.2	7.3

Averages by months show that M. aencylivorus was found in a higher percentage of the orchards each month during the season, with its peak during June and July, than any other species. The highest parasitization of Glypta rufiscutellaris and Macrocentrus delicatus occurred in July and August.

Table 7. - Monthly and seasonal occurrence, by counties of the principal parasite species.

Species	May		June		July		August		Entire season	
	Number of occurrences	Percent parasitization								
<u>Macrocentrus aencylivorus</u>	23	32.5	51	36.3	30	36.0	14	25.5	118	34.2
<u>Glypta rufiscutellaris</u>	7	1.2	38	5.5	30	13.0	10	9.7	85	8.3
<u>Macrocentrus delicatus</u>	4	1.5	34	6.8	11	9.6	9	15.5	58	8.3
<u>Cremastus minor</u>	8	2.9	31	11.2	7	4.9	2	2.0	48	8.5
<u>Macrocentrus instabilis</u>	8	12.0	20	3.1	8	1.3	8	1.5	44	4.1
<u>Eubadizon pleurale</u>	4	3.5	27	3.9	7	2.5	2	1.3	40	3.4
<u>Pristomerus ocellatus</u>	1	-	18	2.7	14	2.4	2	3.9	34	2.7
<u>Diocetes molestae</u>	5	6.0	16	9.2	6	15.1	2	33.5	29	11.5

PLANS FOR THE 1939 SEASON

The primary function of the oriental fruit moth parasite investigations of the Bureau of Entomology and Plant Quarantine in its cooperation with State agencies is to contribute to the fullest possible utilization of parasites in reducing the damage by the fruit moth. Recent investigations indicate that there are at present more undeveloped possibilities in work with M. ancylivorus than any other known species. Consequently, during the coming season work with this species will be stressed.

One of the principal lines of activity of the Moorestown project will be a continuation of the experiments in the mass liberations of twig larval parasites (principally M. ancylivorus). Associated with the mass liberation experiments will be continued work on methods for the inexpensive production of M. ancylivorus and for obtaining large numbers earlier in the season than they can be obtained from first brood strawberry leaf roller. These two phases of work will not require any active cooperation with state cooperating agencies during the current season.

Insofar as possible, the Moorestown project will continue to cooperate with the State agencies in their individual plans for completion of the distribution of M. ancylivorus within the borders of their respective States. As during the past year, it is presumed that this will involve the consideration of each instance and an agreement to provide breeding stock, possible assistance in obtaining parasites from the southern New Jersey reservoir, and, in special instances, the shipment of parasites for liberation.

The general recovery program, represented by periodic collections of infested twigs by the Bureau and State agencies, will be appreciably reduced, as it is felt that, in many sections, these have been made for a sufficiently long period to give an adequate estimate of the degree of effectiveness attained by the different species. The only important exceptions are certain imported species which appear to be in the process of acclimatization, and natives like M. ancylivorus, being released in sections in which their final establishment may be questionable. The restricted program on recovery includes follow-up collections in those locations from which imported species have previously been recovered, a study of the effect of M. ancylivorus on parasitism immediately following release in any new section in which it may be released this season, and a fairly intensive survey of twig parasitism in about 20 orchards in 3 states in connection with the studies on correlation between twig larval parasitism and fruit injury. In this work the cooperation of certain State agencies in the continued collection of infested twigs will be requested, and rearing will be made at Moorestown and reported, as usual, to the respective cooperating agencies.

In addition to the recovery work described above, the only work on imported parasites considered is the rearing of limited numbers of certain species to be shipped to cooperating State agencies for release in sections where such species have not previously been released, in the hope of obtaining establishment in some environment where such species may become

established and increase to a point of dominance. Information obtained from the survey work as outlined above should give sufficient information to permit the resumption of importation, rearing, and continued colonization of any of the introduced species whenever they show indications of increasing importance at any time or place. Importations from Japan and Chosen (Korea) will be limited to relatively small numbers of certain species which are desired for further testing. Major attention will be devoted to alternate host studies to determine if the presence of these are essential in the seasonal cycle of the different species.

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Chief of Bureau

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